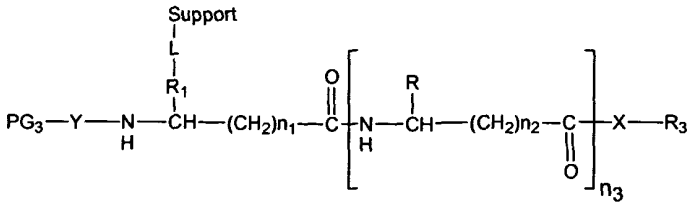
## CLAIMS

What is claimed is:

1. A thioester or selenoester generator comprising an amino acid synthon having an N-terminal group joined to a C-terminal group through an organic backbone comprising one or more carbons, said organic backbone comprising a carbon having a side chain anchored to a support through a nucleophile-stable linker and lacking reactive functional groups, said N-terminal group comprising an unprotected or protected N-terminal group, with the proviso that the protecting group of said protected N-terminal group is removable under non-nucleophilic conditions, and said C-terminal group comprising a moiety selected from the group consisting of a thioester or selenoester.

2. A thioester or selenoester generator having the formula:

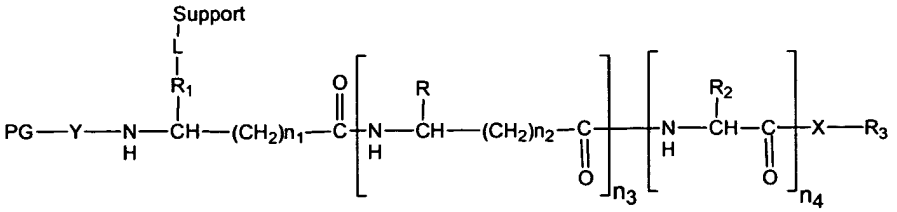



wherein $PG_3$ is a nucleophile-stable protecting group that may be present or absent; Y is a target molecule of interest that may be present or absent and is lacking reactive functional groups; Support is a solid phase, matrix, or surface; L is a nucleophile-stable linker; $R_1$ is a divalent radical lacking reactive functional groups; R is hydrogen or an organic side-chain lacking reactive functional groups; $n_1$ and $n_2$ each are from 0 to 2; $n_3$ is from 0 to 20; X is sulfur or selenium; and $R_3$ is any group compatible with thioesters or selenoesters.

3. A sterically hindered thioester or selenoester generator comprising an amino acid synthon having an N-terminal group joined to a C-terminal group through an organic backbone comprising one or more carbons, said organic backbone comprising a carbon having a side chain anchored to a support through a nucleophile-stable linker and lacking reactive functional groups, said the N-terminal group comprises a

unprotected or protected N-terminal group, and the C-terminal group comprises a moiety selected from the group consisting of a sterically hindered thioester or selenoester.

4. A sterically hindered thioester or selenoester generator having the formula:




wherein PG is a protecting group that may be present or absent; Y is a target molecule of interest that may be present or absent and is lacking reactive functional groups; Support is a solid phase, matrix, or surface; L is a nucleophile-stable linker; $R_1$ is a divalent radical lacking reactive functional groups; each R individually is any side chain group and may be the same or different, each $R_2$ comprises any side chain group, and R and R2 are lacking reactive functional groups; $n_1$ and $n_2$ each individually is 0, 1 or 2; $n_3$ is 0 to 20; $n_4$ is 0 or 1; X is sulfur or selenium; and $R_3$ is any thioester or selenoester compatible group; and wherein one or both of $R_2$ and $R_3$ is a group that sterically hinders the thioester or selenoester moiety -C(O)-X-.

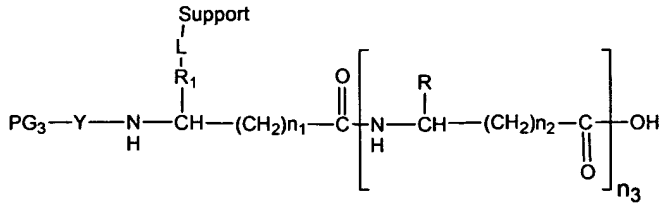
5. A method of production for a thioester or selenoester generator, said method comprising:

(a) providing a composition comprising an amino acid synthon having an N-terminal group joined to a C-terminal group through an organic backbone comprising one or more carbons, said organic backbone comprising a carbon having a side chain anchored to a support through a nucleophile-stable linker and lacking reactive functional groups, said N-terminal group comprising an unprotected or protected N-terminal group, with the proviso that said N-terminal protecting group is removable under non-nucleophilic conditions, and said C-terminal group comprising a free carboxyl; and

(b) converting said free carboxyl of the product step (a) to a thioester or selenoester.

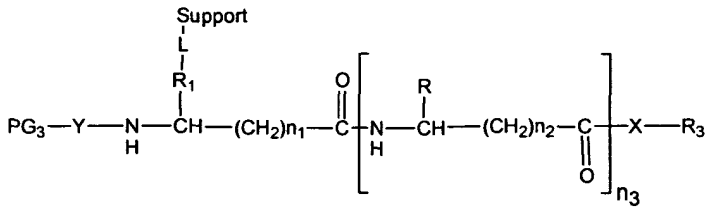
6. A method of production for a thioester or selenoester generator, said method comprising:

(a) providing a composition having the formula:




wherein $PG_3$ is a nucleophile-stable protecting group that may be present or absent; Y is a target molecule of interest that may be present or absent and is lacking reactive functional groups; Support is a solid phase, matrix, or surface; L is a nucleophile-stable linker; $R_1$ is a divalent radical lacking reactive functional groups; R is hydrogen or an organic side-chain lacking reactive functional groups; $n_1$ and $n_2$ each are from 0 to 2; and $n_3$ is from 0 to 20; and

(b) converting the free carboxyl of step (a) to a thioester or selenoester to form a thioester or selenoester generator having the formula:




wherein X is sulfur or selenium; and $R_3$ is any group compatible with thioesters or selenoesters.

7. A method of production for a sterically hindered thioester or selenoester generator, said method comprising:

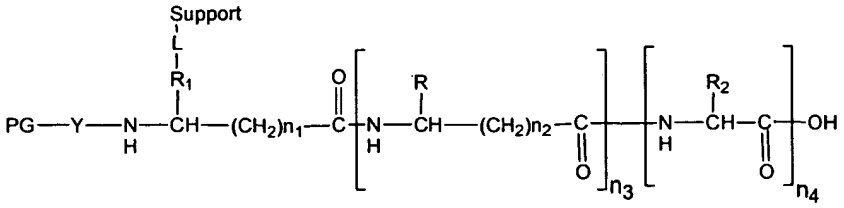
(a) providing a composition comprising an amino acid synthon having an N-terminal group joined to a C-terminal group through an organic backbone comprising one or more carbons, said organic backbone comprising a carbon having a side chain anchored to a support through a nucleophile-stable linker

and lacking reactive functional groups, said N-terminal group comprising an unprotected or protected N-terminal group, and said C-terminal group comprising a free carboxyl; and

(b) converting said free carboxyl of the product step (a) to a sterically hindered thioester or selenoester.

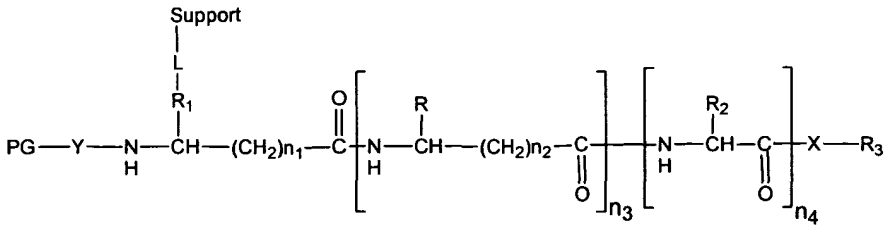
8. A method of production for a sterically hindered thioester or selenoester generator, said method comprising:

(a) providing a composition having the formula:




wherein PG is a protecting group that may be present or absent; Y is a target molecule of interest that may be present or absent and is lacking reactive functional groups; L is a nucleophile-stable linker; Support is a solid phase, matrix, or surface; $R_1$ is a divalent radical lacking reactive functional groups; R and $R_2$ each individually are any side chain group that may be the same or different and are lacking reactive functional groups, and wherein $R_2$ is any group compatible with thioesters or selenoesters; $n_1$ and $n_2$ each individually is 0, 1 or 2; $n_3$ is 0 to 20; and $n_4$ is 0 or 1; and

(b) converting the free carboxyl of step (a) to a sterically hindered thioester or selenoester having the formula:




wherein X is sulfur or selenium; and $R_3$ is any group compatible with thioesters or selenoesters; and wherein one or both of $R_2$ and $R_3$ is a group that sterically hinders the thioester or selenoester moiety -C(O)-X-.

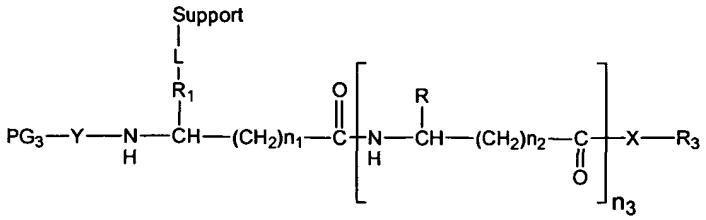
9. A method of production for a thioester and selenoester compound, said method comprising:

(a) providing a thioester or selenoester generator comprising an amino acid synthon having an N-terminal group joined to a C-terminal group through an organic backbone comprising one or more carbons, said organic backbone comprising a carbon having a side chain anchored to a support through a nucleophile-stable linker and lacking reactive functional groups, said N-terminal group comprising an unprotected or protected N-terminal group, with the proviso that the N-terminal protecting group is removable under non-nucleophilic conditions, and said C-terminal group comprising a moiety selected from the group consisting of a thioester or selenoester; and

(b) cleaving said linker under non-nucleophilic conditions to generate a thioester or selenoester compound free of said support.

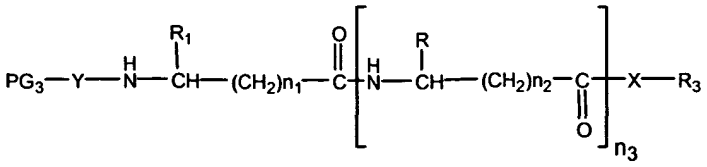
10. A method of producing a thioester and selenoester compound, said method comprising:

(a) providing a thioester or selenoester generator having the formula:

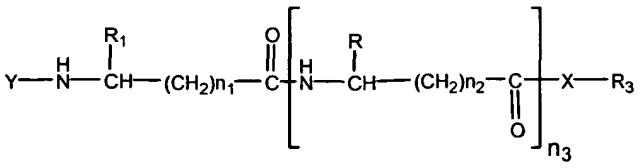



wherein $PG_3$ is a nucleophile-stable protecting group that may be present or absent; Y is a target molecule of interest that may be present or absent and is lacking reactive functional groups; L is a nucleophile-stable linker; Support is a solid phase, matrix, or surface; $R_1$ is a divalent radical lacking reactive functional groups; R is hydrogen or an organic side-chain lacking reactive functional groups; $n_1$ and $n_2$ each are from 0 to 2; $n_3$ is from 0 to 20; X is sulfur or selenium; and $R_3$ is any group compatible with thioesters or selenoesters; and

(b) cleaving linker L under non-nucleophilic conditions to generate a thioester or selenoester compound free of said support, said thioester or selenoester compound having a formula selected from the group consisting of:



and



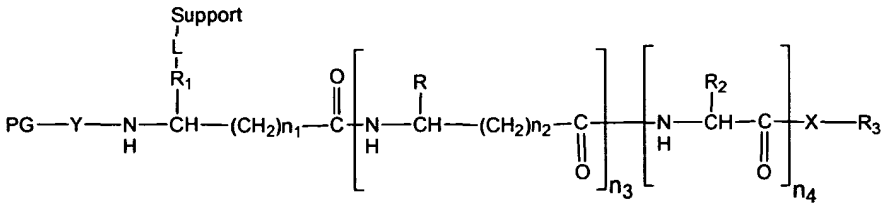
11. A method of producing a sterically hindered thioester or selenoester compound, said method comprising:

(a) providing a thioester or selenoester generator comprising an amino acid synthon having an N-terminal group joined to a C-terminal group through an organic backbone comprising one or more carbons, said organic backbone comprising a carbon having a side chain anchored to a support through a nucleophile-stable linker and is lacking reactive functional groups, said N-terminal group comprising an unprotected or protected N-terminal group, and said C-terminal group comprising a moiety selected from the group consisting of a sterically hindered thioester or selenoester; and

(b) cleaving said linker under non-nucleophilic conditions so as to generate a sterically hindered thioester or selenoester compound free of said support.

12. A method of producing a sterically hindered thioester or selenoester compound, said method comprising:

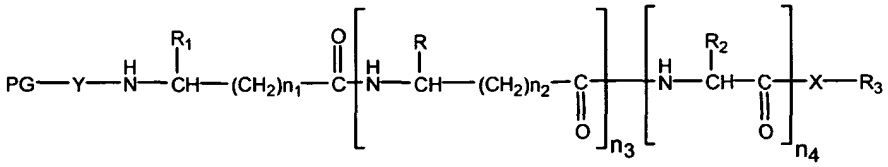
(a) providing a thioester or selenoester generator having the formula:



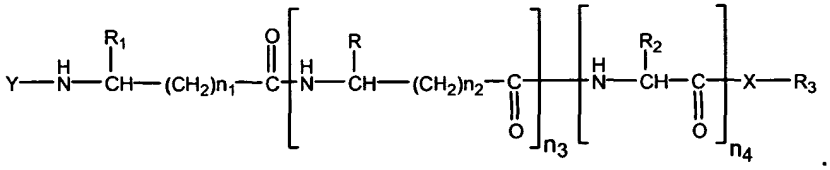
wherein PG is a protecting group that may be present or absent; Y is a target molecule of interest that may be present or absent and is lacking reactive

functional groups; L is a nucleophile-stable linker; Support is a solid phase, matrix, or surface; $R_1$ is a divalent radical lacking reactive functional groups; each R individually is any side chain group and may be the same or different, each $R_2$ comprises any side chain group, and R and R2 are lacking reactive functional groups; $n_1$ and $n_2$ each individually is 0, 1 or 2; $n_3$ is 0 to 20; $n_4$ is 0 or 1; X is sulfur or selenium; and $R_3$ is any thioester compatible group; and wherein one or more of $R_2$ and $R_3$ is a group that sterically hinders the thioester or selenoester moiety -C(O)-X-; and

(b) cleaving linker L under non-nucleophilic conditions to generate a sterically hindered thioester or selenoester compound free of said support, said sterically hindered thioester or selenoester compound having a formula selected from the group consisting of:



and



13. A method of nucleophile-based production of a thioester or selenoester generator, said method comprising:

(a) providing a composition comprising an amino acid synthon having an N-terminal group joined to a C-terminal group through an organic backbone comprising one or more carbons, said N-terminal group comprising a reactive functional group protected with a nucleophile-labile protecting group, said C-terminal group comprising a carboxyl protected with a carboxyl protecting group removable under conditions orthogonal to said nucleophile-labile protecting group and said organic backbone lacking reactive functional groups and comprising a carbon having a side chain

anchored to a support through a nucleophile-stable linker cleavable under conditions orthogonal to the carboxyl protecting group;

(b) removing said nucleophile-labile protecting group from said composition of step (a) under nucleophile conditions and forming an N-terminal group comprising a first reactive functional group;

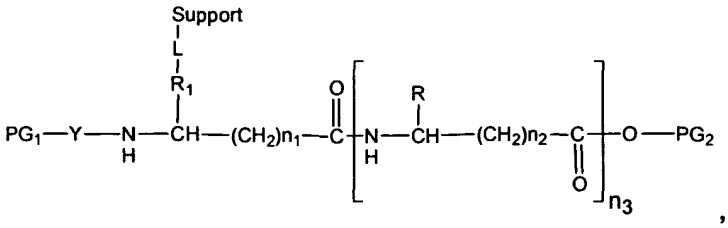
(c) coupling to the product of step (b), a compound forming a covalent bond with said first reactive functional group to form an elongated product, where the compound is selected from a group consisting of: (i) an unprotected compound comprising a single reactive moiety that forms said covalent bond with said first reactive functional group; (ii) a protected compound comprising a single reactive moiety that forms said covalent bond with said first reactive functional group, and an amine protected with a nucleophile-stable amino protecting group removable under conditions orthogonal to removal of said carboxyl protecting group; and (iii) a protected compound comprising a single reactive moiety that forms said covalent bond with said first reactive functional group and one or more additional reactive functional groups protected with a protecting group removable under conditions orthogonal to removal of said carboxyl protecting group;

(d) removing from the product of step (c), said carboxyl protecting group to generate a free carboxyl group; and

(e) converting said free carboxyl group to produce a thioester or selenoester.

14. A method of nucleophile-based production of a thioester or selenoester generator, said method comprising:

(a) providing a thioester or selenoester generator having the formula:

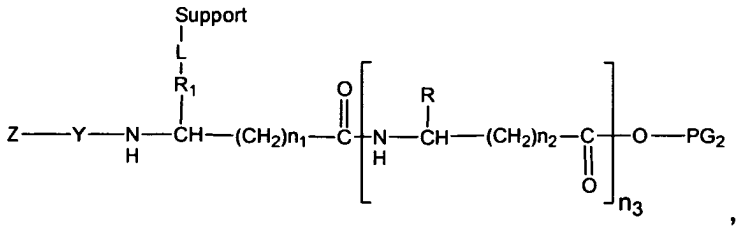



,

wherein $PG_1$ is a nucleophile-labile protecting group that may be present or absent; Y is a target molecule of interest that may be present or absent and is lacking reactive functional groups; Support is chosen from a solid phase, matrix, or surface; L

is a nucleophile-stabile linker; $R_1$ is a divalent radical lacking reactive functional groups; R is hydrogen or any organic side-chain lacking reactive functional groups; $n_1$ and $n_2$ each are from 0 to 2, and $n_3$ is from 0 to 20; and $PG_2$ is any protecting group that is removable under conditions orthogonal to removal of $PG_1$ and cleavage of L;

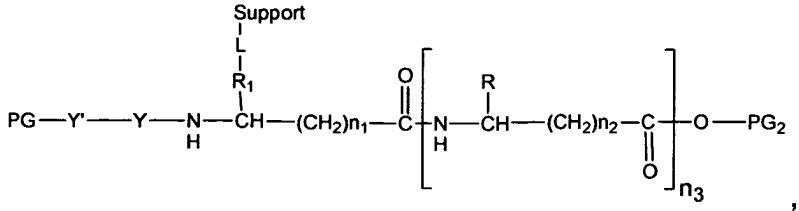
(b) removing said nucleophile-labile protecting group from the composition of step (a) to generate a composition having the formula:




,

wherein Z comprises a reactive functional group of interest;

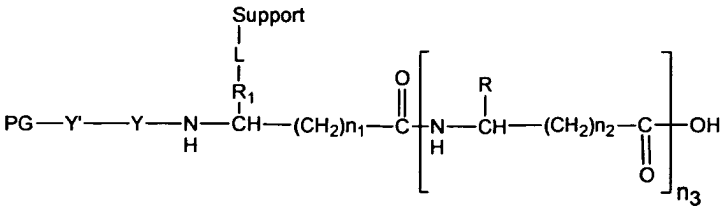
(c) coupling said reactive functional group of the composition of step (b) to a compound of interest and forming an elongated product having the formula:




,

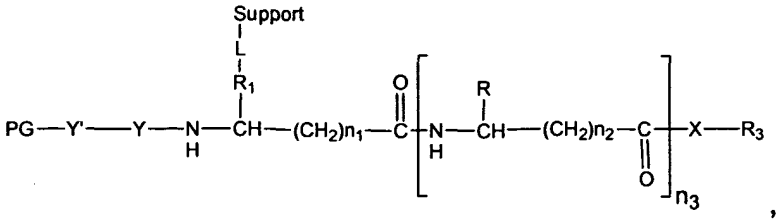
wherein Y' is a compound of interest lacking reactive functional groups; and PG may be present or absent, with the proviso that when present, PG is a nucleophile-stable amino protecting group removable under conditions orthogonal to $PG_2$ and Y' comprises an N-terminal amino group that is protected by PG;

(d) removing said carboxyl protecting group from the product of step (c) to generate a free carboxyl group having the formula:




; and

(e) converting the product of step (d) to a thioester or selenoester of the formula:




wherein X is sulfur or selenium; and $R_3$ is any group compatible with thioesters or selenoesters.

15. A method of nucleophile-based production of a sterically hindered thioester or selenoester generator, said method comprising:

(a) providing a composition comprising an amino acid synthon having an N-terminal group joined to a C-terminal group through an organic backbone comprising one or more carbons, said N-terminal group comprising a reactive functional group protected with a nucleophile-labile protecting group, said C-terminal group comprising a carboxyl protected with a carboxyl protecting group removable under conditions orthogonal to said nucleophile-labile protecting group and said organic backbone lacking reactive functional groups and comprising a carbon having a side chain anchored to a support through a nucleophile-stable linker cleavable under conditions orthogonal to the carboxyl protecting group;

(b) removing said nucleophile-labile protecting group from said composition of step (a) under nucleophile conditions and forming an N-terminal group comprising a first reactive functional group;

(c) coupling to the product of step (b), a compound forming a covalent bond with said first reactive functional group to form an elongated product, where the compound is selected from a group consisting of: (i) an unprotected compound comprising a single reactive moiety that forms said covalent bond with said first reactive functional group; (ii) a protected compound comprising a single reactive moiety that forms said covalent bond with said first reactive functional group, and an amine protected with a nucleophile-stable amino protecting group removable under conditions orthogonal to removal of said carboxyl protecting group; and (iii) a protected compound

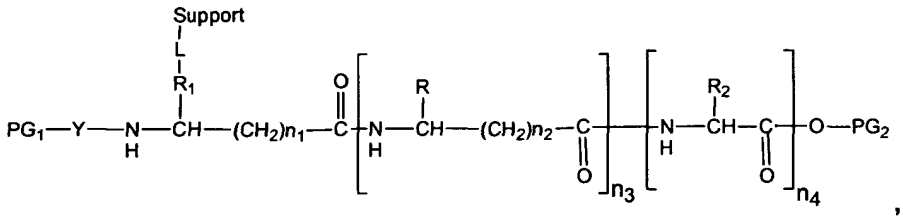
comprising a single reactive moiety that forms said covalent bond with said first reactive functional group and one or more additional reactive functional groups protected with a protecting group removable under conditions orthogonal to removal of said carboxyl protecting group;

(d) removing from the product of step (c), said carboxyl protecting group to generate a free carboxyl group; and

(e) converting said free carboxyl group to produce a thioester or selenoester, with the proviso that the converting the product of step (d) formed from the elongated product of step (c)(iii) comprises generating a sterically hindered thioester or selenoester.

16. A method of nucleophile-based production of a thioester or selenoester generator, said method comprising:

(a) providing a thioester or selenoester generator having the formula:

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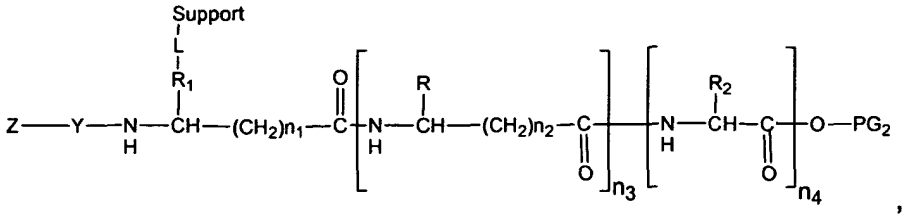
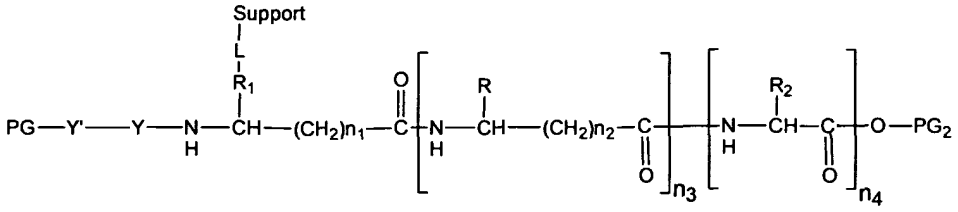
wherein $PG_1$ is a nucleophile-labile protecting group that may be present or absent; Y is a target molecule of interest that may be present or absent and is lacking reactive functional groups; Support is chosen from a solid phase, matrix, or surface; L is a nucleophile-stabile linker; $R_1$ is a divalent radical lacking reactive functional groups; R and $R_2$, each individually, are hydrogen or any organic side-chain lacking reactive functional groups; $n_1$ and $n_2$, each individually, are from 0 to 2, $n_3$ is from 0 to 20, $n_4$ is 0 or 1; and $PG_2$ is any protecting group that is removable under conditions orthogonal to removal of $PG_1$ and cleavage of L;

(b) removing said nucleophile-labile protecting group from the composition of step (a) to generate a composition having the formula:



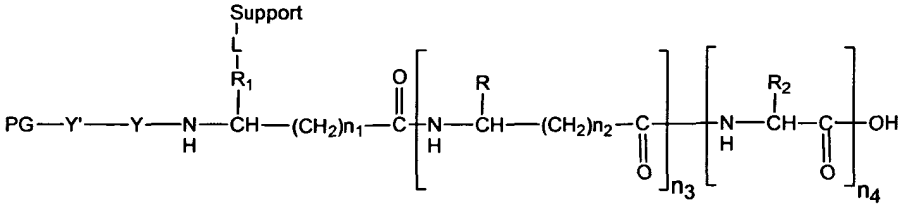
wherein Z comprises a reactive functional group of interest;

(c) coupling said reactive functional group of the composition of step (b) to a compound of interest and forming an elongated product having the formula:



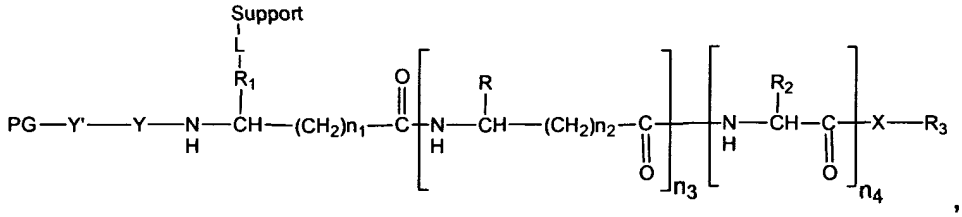
wherein Y' is a compound of interest lacking reactive functional groups; and PG may be present or absent, with the proviso that, if present, PG is a nucleophile-stable amino protecting group removable under conditions orthogonal to $PG_2$;

(d) removing said carboxyl protecting group from the product of step (c) to generate a free carboxyl group having the formula:



; and

(e) converting the product of step (d) to a thioester or selenoester of the formula:



wherein X is sulfur or selenium; $R_2$ is one or more of any group that sterically hinders said thioester or selenoester; and $R_3$ is any group compatible with thioesters or selenoesters; and wherein one or both or $R_2$ and $R_3$ is a group that sterically hinders said thioester or selenoester.